"Real-world" radiomics in MRI

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Abstract

Texture analysis has a long history in MRI. However, it remained a somewhat niche topic until a series of key papers in the mid-2010s led to a paradigm-shift in our methods of data analysis. The realisation that statistical modelling methods originally developed in the -omics fields could be applied to large numbers of automatically-generated imaging features led to the field of *radiomics*. A number of encouraging initial results have been followed by a period of technical consolidation, most recently culminating in work by the Imaging Biomarker Standardisation Initiative.

MRI poses numerous challenges to such efforts in standardisation, challenges that the IPEM community is well placed to address. In contrast to the case of x-ray CT (where the Hounsfield number of a tissue is a standardised quantity that is relatively easy to measure with a known degree of accuracy), quantitative images in MRI are already difficult to standardise, even before the additional complexities of radiomics feature generation are introduced. Furthermore, the range of acquisition options available is vast. Differences in spatial resolution, slice thickness, slice profiles, relaxation parameters, sequence timings, k-space trajectories, multi-coil combinations, reconstruction methodologies and, now, AI-based acquisition acceleration strategies all have the potential to change the measured feature values.

Amid this array of potential pitfalls, how do we make progress in MRI radiomics? This talk will explore one approach, which we have termed "real-world" radiomics and I will present the results of an MRI radiomics study in breast cancer that exemplifies some of these issues.

About Dr Simon Doran

Dr Simon Doran is a senior staff scientist in the Division of Radiotherapy and Imaging at The Institute of Cancer Research, London, where he leads the effort in advanced imaging informatics. Dr Doran gained his first degree in physics and theoretical physics at the University of Cambridge and obtained a PhD in quantitative magnetic resonance imaging at

the laboratory of Professor Laurie Hall. After a hugely enjoyable period of postdoctoral research in ultra-rapid MR imaging with the team of Prof Michel Décorps (INSERM U438) in Grenoble, he lectured for 11 years in the Department of Physics at the University of Surrey before moving to the ICR in 2006.

Dr Simon Doran manages the UK-wide Repository Unit of CRUK's National Cancer Imaging Translational Accelerator (NCITA) and, locally, he works on the development of the ICR's Research PACS platform for archiving and visualising image data. Both of these efforts are centred around the XNAT image archive platform, which is rapidly gaining traction as a leading open-source solution for academic imaging data management. The philosophy behind these developments is described in Doran *et al.* Radiographics 32, 2135–2150 (2012). Ongoing work in the group is customising the XNAT to meet the needs of the cancer imaging community, with a particular focus on the areas of online visualisation of image data, radiology-radiotherapy integration, clinical trials, multimodality imaging and preclinical imaging.

Simon's other interests include 3D optical computed tomography (CT) microscopy and high-resolution MRI in the imaging of cancer tissues. His research explores use of 3D radiation dosimetry using optical CT in combination with radiochromic dosimeters, particularly PRESAGE®. This work concentrates on high-resolution microimaging of doses delivered in synchrotron microbeam radiotherapy. Dr Simon Doran is a member of the EU's SYRA3 COST Action TD1205 – a multidisciplinary network to develop synchrotron radiotherapy and radiosurgery techniques to treat brain tumours and other diseases of the central nervous system.